

Postdoctoral research fellow at UCL

Research focus:

My research focuses on the analysis of current and future observations of exoplanets to understand the physics and the chemistry of their atmospheres. Using data-oriented techniques, I have characterised the atmosphere of planets ranging from the temperate super-Earth LHS-1140b to the extremely-hot Jupiter KELT-9b. I have pioneered in the characterisation of degenerate behaviours through simulated and real data analyses and developed new tools adapted to the study of large populations and phase curve observations. I also used those tools to evaluate the performances of next generation telescopes such as Ariel and JWST in answering some of the major questions of the field. My approach emphasises on the importance of mixing multiple disciplines to better understand exoplanet atmospheres.

Current position:

2021 – Now: Postdoctoral research fellow in exoplanetary atmospheres and Ariel performances at UCL

Education:

- **2018-2021:** PhD in Physics and Astronomy - *University College London* (UK) – Title: Next generation techniques to characterise exoplanetary atmospheres – Supervisor: Prof. Giovanna Tinetti.
- **2017-2018:** Master (MASt) in Applied Mathematics (Part III) - *University of Cambridge* (UK) – Grade: 71%
- **2015-2016:** Master (MSc) in Environmental Technology - *Imperial College* (London, UK) – Grade: Merit
- **2013-2016:** Master (MEng) in General Engineering - *Ecole des Mines* (Douai, FRA) – Grade: 15.1/20
- **2010-2013:** CPGE: Equiv. Bachelor Degree in Mathematics/Physics - *Lycée Daudet* (FRA) – Grade: A

Research Articles:

8 main author articles (5 published) and about 20 co-authored works.

- **Changeat** and Edwards(2020): The Hubble WFC3 Emission Spectrum of the Extremely-Hot Jupiter, KELT-9b, Submitted to ApJL.
- **Changeat**, et al. (2020): An exploration of model degeneracies with a unified phase curve retrieval analysis: The light and dark sides of WASP-43 b, Submitted to ApJ.
- **Changeat**, et al. (2020): KELT-11 b: Abundances of water and constraints on carbon-bearing molecules from the Hubble transmission spectrum, ApJ - arXiv:2010.01310.
- **Changeat** and Al-Refaie (2020): TauREx3 PhaseCurve: A 1.5D model for phase curve description, ApJ - arXiv:2006.14237.
- **Changeat**, et al. (2020): Alfnor: A Retrieval Simulation of the Ariel Target List, AJ - arXiv:2003.01839.
- **Changeat**, et al. (2020): Disentangling Atmospheric Compositions of K2-18 b with Next Generation Facilities, Submitted.
- **Changeat**, et al. (2020): Impact of planetary mass uncertainties on exoplanet atmospheric retrievals, ApJ - arXiv:1908.06305
- **Changeat**, et al. (2019): Towards a more complex description of chemical profiles in exoplanets retrievals: A 2-layer parameterisation, ApJ - arXiv:1903.11180.
- Yip, **Changeat**, et al. (2020): Peeking inside the Black Box: Interpreting Deep Learning Models for Exoplanet Atmospheric Retrievals, Submitted to ApJ - arXiv:2011.11284.
- Edwards, **Changeat**, et al. (2020): Hubble WFC3 Spectroscopy of the Habitable-zone Super-Earth LHS 1140 b, ApJ - arXiv:2011.08815.
- Guilluy et al. (2020): ARES IV: Probing the atmospheres of the two warm small planets HD 106315 c and HD 3167 c with the HST/WFC3 camera, ApJ - arXiv:2011.03221.
- Yip, **Changeat**, et al. (2020): On the Compatibility of Ground-based and Space-based Data: WASP-96 b, An Example, ApJ - arXiv:2009.10438.
- Anisman et al. (2020): WASP-117 b: an eccentric hot-Saturn as a future complex chemistry laboratory, ApJ - arXiv:2009.08916.
- Pluriel et al. (2020): ARES III: Unveiling the Two Faces of KELT-7 b with HST WFC3, ApJ - arXiv:2006.14199.
- Skaf et al. (2020): ARES II: Characterising the Hot Jupiters WASP-127 b, WASP-79 b and WASP-62 b with HST, ApJ - arXiv:2005.09615.
- Edwards, **Changeat**, et al. (2020): ARES I: WASP-76 b, A Tale of Two HST Spectra, ApJ - arXiv:2005.02374.

- Edwards, **Changeat**, et al. (2020): Original Research By Young Twinkle Students (ORBYTS): Ephemeris Refinement of Transiting Exoplanets, MNRAS - arXiv:2005.01684.
- Bourgalais, Carrasco, **Changeat**, et al. (2020): Ions in the Thermosphere of Exoplanets: Observable Constraints Revealed by Innovative Laboratory Experiments, ApJ - arXiv:2004.12872.
- Barstow, **Changeat**, et al. (2020): A comparison of exoplanet spectroscopic retrieval tools, MNRAS - arXiv:2002.01063
- Al-Refaie, **Changeat**, et al. (2020): TauREx III: A fast, dynamic and extendable framework for retrievals, Submitted - arXiv:1912.07759.

Participation to conferences, talks and invitations:

- **Now -2018:** Participation and presentations to ESA Ariel Consortium meetings (about 10 presentations).
- **2020 Mar- Apr:** Research visit to Tokyo University: Collaboration with the Tokyo exoplanet group on interactions between atmospheres and interiors.
- **2020 Jan:** Poster presentation at the Ariel public conference in ESA-ESTEC.
- **2020 Jan:** Talk and poster presentations at the Rocky Exo-worlds conference in Cambridge.
- **2019 Nov:** Research visit to Edinburg University. Collaboration and preparation of a research article.
- **2019 Oct:** Participation to the Okinawa Exoplanet conference and research visit to Tokyo University.
- **2019 Sep:** Talk at the EPSC-DPS conference (Lyon).
- **2019 Aug:** Poster presentation at the Extreme Solar System conference (Iceland).
- **2019 Aug:** Attendance to the TESS general conference at MIT.
- **2019 Jul:** Research visit and invited talk at the University of California Berkeley (Prof. Courtney Dressing).
- **2019 Jul:** Research visit and invited talk at the NASA JPL centre (Prof. Mark Swain).
- **2019 Jul:** Research visit and invited talk at Caltech (Prof. Yuk Yung).
- **2019 Feb:** Participation to the NASA TESS Workshop at the STScl.
- **2019 Feb:** Research visit to Columbia (Prof. David Kipping).
- **2019 Feb:** Talk at the UCL APEX seminar series.
- **2019 Feb:** Organisation and animation of a TauREx 2h-tutorials for the Prague Digital Exoplanets conference.

Summer Schools:

- **2019 Sep:** Participation and teaching to the ARES Summer school
- **2019 Jul:** Poster presentation at the Sagan Summer School in Caltech.
- **2019 Jun:** Participation to the PennState Summer School in Astrostatistics.
- **2019 Mai:** Participation to the ASES3 Summer School in Vietri.

Teaching and Public events:

- **2020 to now:** Supervision MSc thesis - Alexandra Thompson.
- **2020 Dec:** Astronomines Conference (Online) - Invited public talk at Ecole des Mines Saint-Etienne.
- **2019:** Supervision MSc thesis - Luke Keyte: This led to a publication.
- **2019 Nov:** Conférence Astronomie (Ales) - Series of 3 public talks and interventions (open to all, reserved for students, for literature students) at Lycee Jacques Prevert and Saint-Christol-les-Ales.
- **2019 Oct:** Public talk Tokyo Space Cafe (Tokyo) - Public talk.
- **2019 Sep:** Ariel Summer School ARES (Biarritz) - Teaching to about 20 PhD/PostDocs the use of atmospheric retrieval tools. This led to 5 co-publications.
- **2018 - 2019:** Marking - Marking of coursework and exams for the UCL Exoplanet course.
- **2018 - 2020:** ORBYTS teaching program - Weekly teaching of exoplanet science for high school student. Planification of observations with the LCO and TelescopeLive networks to characterise ephemerids of transiting planets. Two publications.

Awards and prizes:

- **2019 Sep:** CNES funding to teach at the Biarritz Summer School.
- **2019 Aug:** NASA/MIT bursary to attend the TESS conference.
- **2019 Jul:** NASA scholarship to attend and the Sagan Summer School at Caltech.
- **2019 May:** Europlanet grant to participate to the ASES3 Summer School in Vietri.

- **2019 Oct:** ESA bursary to attend the Ladybird training course.
- **2018 Oct:** E.M. Burnett Prize in recognition of excellent results from Cambridge University.
- **2015 Dec:** Ecole des Mines grant supporting the double degree with Imperial College London.

Other Professional experiences:

- **2018 Sept:** **ESA Ladybird Guide to Operation Spacecraft training course** (Libramont, BE)
1-week course on spacecraft operations, learning through practical examples. Simulation of a spacecraft failure.
- **2016 Oct – 2017 Sep:** **Consultant in IT at Wavestone** (Paris, FRA)
Designing and securing Alstom new IT system by giving cybersecurity advices, assessing IT operations (flow openings, VPN configurations, security exceptions...) and more generally assisting every level of their IT migration.
- **2015 Nov - 2016 Feb:** **Freelance Consultant in Aerospace at OutSmart Insights Ltd** (London, UK)
Technology scanning and advices for an aerospace company (BAE Systems). Identification of key technologies and their applications to jet aircrafts. Assessment of TRL and patent identification.
- **2015 May-Sept:** **Internship at TOTAL SA. Study of R&D localization** (Pau, FRA)
Assistance to TOTAL's strategy of R&D reorganisation by comparing the R&D potential of 11 countries. Use of a multicriteria approach based on analysing reports and conducting interviews with TOTAL's collaborators.

Other Research Projects:

- **2018 Jan-May:** **MASt Essay on "Redshift Space Distortion" at the University of Cambridge.**
Exploring how peculiar velocity impacts the observed repartition of galaxies. Understanding and reproducing main literature results. Calculation of the power spectrum in Kaiser linear and CLPT cases.
- **2016 Apr-Oct:** **MSc Thesis on "The impact of Shading and orientation issues on Solar Panels performances" at Imperial College London.**
Building of a statistical method to detect solar panels with shading and orientation issues. Creation of a java software to analyse a large dataset of panel outputs. Assessment of the amount of energy lost in UK due to these issues.
- **2015 Jan-May:** **Research Project on "Low Reynold flows around Ellipsoid obstacles" at Ecole des Mines.**
Study of the impact of variables (flow speed, flow characteristics, obstacle shape, obstacle angle...) on drag and lift coefficients through numerical simulations with ANSYS Fluent.
- **2014 May-Aug:** **Internship on "Small cost collaborative energy solution for summerhouses" at Aalborg University.**
Creation of a thermal model for off-grid summerhouses and comparison of energy solutions for heat and electricity. Temperature monitoring and data analysis.
- **2013 Jan-Jul:** **Research Project on "Numerical and Perturbative methods for the 3-bodies problem" at Lycée Daudet.**
Creation of a 3-Dimensional model (programmed in Java + OpenGL) in order to compare the Perturbative and the Runge Kutta methods for the 3-Bodies problem. Assessment on the Sun-Earth-Moon system and comparison with the Online NASA database.

Languages, Skills and Hobbies:

Languages:

- French: Mother tongue
- English: Fluent (TOEIC 905/990 – IELTS 7,5/9)

Computer Skills:

- Numerical Modelling (ANSYS, Solidworks)
- Programming (C, Python Java, HTTP)

Hobbies:

- Telescope observations
- Gliding
- Skiing: Competition & teaching (23 years).
- Volleyball: Alès and Douai Clubs (8 years)
- Kitesurfing (10 years)